120

OIPE NOV 1 9 2003 PATENT & TRADEMARK OFFICE

AF/2832 #14 Appeal Brief J. White 12-10-03

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Applicants: Hong Wan

Serial No.: 10/047,207

Filed: January 15, 2002

For: **INTEGRATED MAGNETIC FIELD STRAP FOR SIGNAL ISOLATOR**

Group Art Unit: 2832

Examiner: K. Easthom

Attorney Docket No.: H0002254

I hereby certify that this paper is being deposited with the United States Postal Service as first class mail, postage pre-paid, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this date:

November 17, 2003
(Date)

Melvin A. Robinson
Reg. No. 31,870
Attorney for Applicants

RECEIVED DEC - 1 2003 TECHNOLOGY CENTER 2800

APPELLANT'S BRIEF

Mail Stop Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Pursuant to the provisions of 37 CFR §1.192, Appellants submit the following brief.

1. Real Party in Interest

11/21/2003 AWONDAF1 00000029 10047207

01 FC:1402 330.00 OP

The real party in interest is Honeywell International, Inc. of Morristown, N.J.

2. Related Appeals and Interferences

There are no other appeals and interferences known to Appellants, Appellants' legal representatives or assignees which will directly affect or be affected by or have a bearing on the Board's decision in the pending appeal.

3. Status of Claims

Claims 1-35 are pending. The final rejection of claims 1-17 and 31-35 is appealed. Claims 18-30 are withdrawn form consideration as being directed to a non-elected invention.

4. Status of Amendments

All amendments have been entered.

5. Summary of the Invention

An integrated magnetic signal isolator 10 includes a magnetic sensor 12 having magnetoresistors 14, 16, 18, and 20. A junction 22 between the magnetoresistors 14 and 20 is coupled to a bridge voltage supply, a junction 24 between the magnetoresistors 16 and

18 is coupled to ground, and junctions 26 and 28 between the magnetoresistors 14 and 16 and between the magnetoresistors 18 and 20 provide the output of the magnetic sensor 12.

As shown in Figure 2, the integrated magnetic signal isolator 10 also includes an input strap 30 and a set-reset coil 32. An input current in the input strap 30 flows along the magnetoresistors 14 and 16 from an end 40 to an end 42, and flows along the magnetoresistors 18 and 20 from the end 42 to the end 40, depending on the polarity of the input signal. Thus, the input current in the input strap 30 flows along the magnetoresistors 14 and 16 in one direction and along the magnetoresistors 18 and 20 in the opposite direction.

The turns of the set-reset coil 32 cross the magnetoresistors 14, 16, 18, and 20 perpendicularly and are wound so that they cross the magnetoresistors 14, 16, 18, and 20 in the same orientation. Accordingly, when the set-reset coil 32 receives a set-reset current pulse, current flows across all of the magnetoresistors 14, 16, 18, and 20 in the direction. The set-reset pulse is usually provided before an input is provided to the input strap 30 in order to preset the magnetic moments of the magnetoresistors 14, 16, 18, and 20 in a predetermined direction so that the output provided by the magnetic

sensor 12 in response to an input to the input strap 30 is predictable from measurement to measurement.

As shown in Figure 3, the magnetoresistors 14, 16, 18, and 20 are formed over a dielectric layer 36, which is over a substrate 34. A dielectric layer 38 is formed over the magnetoresistors 14, 16, 18, and 20. The input strap 30 is at least one turn on the dielectric layer 38. A dielectric layer 44 is formed over the input strap 30. The set-reset coil 32 is provided on the dielectric layer 44. A dielectric layer 58 is formed over the set-reset coil 32.

With the integrated magnetic signal isolator 10 shown in Figures 1-3, a uniform external magnetic field of any direction does not contribute to the output differential across output terminals 60 and 62 coupled to the junctions 26 and 28 because the voltages across the magnetoresistors 14 and 20 produced by the external magnetic field track one another as do the voltages across the magnetoresistors 16 and 18.

However, when an input current is applied to the input strap 30, this current generates a magnetic field across the magnetoresistors 14 and 16 that is opposite in direction to the magnetic field generated across the magnetoresistors 18 and 20. These oppositely

oriented magnetic fields produce a differential output across the junctions 26 and 28.

Accordingly, a magnetic signal isolator is provided that has an integrated input strap and magnetic sensor and that produces an output that is substantially immune from a uniform external magnetic field of any direction.

Another embodiment of the magnetic sensor 12 is shown in Figures 4 and 5 where an input strap 70 and a set-reset coil 72 are included in the integrated magnetic signal isolator 10. A dielectric layer 76 is formed over a semiconductor substrate 74. The magnetoresistors 14, 16, 18, and 20 are formed over the dielectric layer 76, and a dielectric layer 78 is formed over the magnetoresistors 14, 16, 18, and 20. The input strap 70 comprises a plurality of turns on the dielectric layer 78. A dielectric layer 88 is formed over the input strap 70, and the set-reset coil 72 is formed over the dielectric layer 88.

As shown in Figure 4, the elongated portions of the turns of the input strap 70 run parallel to elongated portions of the magnetoresistors 14, 16, 18, and 20. The elongated portions of the turns of the reset coil 72 run perpendicularly across the elongated portions of the magnetoresistors 14, 16, 18, and 20, the turns of the

set-reset coil 72 that are across the magnetoresistors 14 and 20 are wound in a clockwise direction, and the turns of the set-reset coil 72 that are across the magnetoresistors 16 and 18 are wound in a counterclockwise direction.

Input current in the input strap 70 flows along the magnetoresistors 14 and 16 from an end 84 to an end 86 and flows along the magnetoresistors 18 and 20 from the end 86 to the end 84, depending on the polarity of the input signal. Thus, the input current in the input strap 70 flows along the magnetoresistors 14 and 16 in one direction and along the magnetoresistors 18 and 20 in the opposite direction.

When the set-reset coil 72 receives a set-reset input, current flows through the set-reset coil 72 across the magnetoresistors 14, 16, 18, and 20 in the same direction.

6. Issues

(a) Whether claims 1-3, 6, 7, 11-14, and 31 are anticipated under 35 U.S.C. §102(b) by Lienhard, et al., U.S. Patent No. 4,596,950 (hereinafter, "the Lienhard '950 patent").

(b) Whether claims 1-17 and 32-35 are anticipated under 35 U.S.C. §102(b) by Wan, U.S. Patent No. 5,952,825 (hereinafter, "the Wan '825 patent").

7. Grouping of Claims

For purposes of this appeal, claims 6, 7, and 8 may be grouped together, and claims 11, 14, and 15 may be grouped together.

Otherwise, the appealed claims are treated separately.

8. Argument

The Lienhard '950 Patent

Four magnetoresistors 1, 2, 3, and 4 form a Wheatstone bridge 5. The Wheatstone bridge 5 is supplied with current I_0, has output terminals 7 and 8, and is subjected to a magnetic field H_a. A current I_m to be measured flows in an input coil 9 and generates a first magnetic field H_m. A feedback current I_h flows in a feedback coil 10 and generates a second magnetic field H_h having a direction opposite to the first magnetic field H_m, so that $H_a = H_m - H_h$. The output voltage of the Wheatstone bridge 5 is fed to an amplifier 11, whose

output is connected to the feedback coil 10 so as to generate the feedback current I_h.

The magnetoresistors 1, 2, 3, and 4 are disposed as shown in Figure 2. The magnetoresistors 1 and 2 are insulated from one another by an insulating layer. The currents I_m and I_h flow through the coils 9 and 10 in the direction shown in Figure 2 and produce the respective magnetic fields H_m and H_h to magnetize the magnetoresistors 1, 2, 3, and 4 in the direction of the hard magnetic axis H_A.

As shown in Figure 3, a current 1/2 I_0 flows in the magnetoresistor 2 thereby generating an auxiliary magnetic field H_b in the magnetoresistor 1 so that a magnetizing vector M in the magnetoresistor 1 is at a predetermined angle with respect to the easy magnetic axis EA. In an analogous manner, auxiliary magnetic fields H_b are generated in the magnetoresistors 2, 3, and 4 which cause magnetizing vectors M in the magnetoresistors 2, 3, and 4 at a predetermined angle with respect to the easy magnetic axis EA. The auxiliary fields $+H_b$ and $-H_b$ are therefore applied in the direction of the hard magnetic axis HA. The resulting change of resistance in all of the magnetoresistors 1, 2, 3, and 4 due to the magnetizing vectors M is equal in all of the

magnetoresistors 1, 2, 3, and 4, and the Wheatstone bridge 5 therefore remains in equilibrium.

However, when the Wheatstone bridge 5 is subjected to the magnetic field H_a, the electrical resistance in the magnetoresistors 1, 2, 3, and 4 differs and results in an output voltage from the Wheatstone bridge 5.

As shown in Figures 4 and 5, the magnetoresistors 1, 2, 3, and 4 are disposed in a common plane. The electrical connections of the ferromagnetic magnetoresistive thin films 1, 2, 3, and 4 correspond to those shown in Figure 3. However, the auxiliary magnetic fields H_b are generated according to Figure 4 by a current-carrying loop 30, which is disposed immediately next to the magnetoresistors 1, 2, 3, and 4. In the arrangement shown in Figure 5, the auxiliary magnetic fields H_b are generated by permanently magnetized layers 13 through 16 disposed immediately below the magnetoresistors 1, 2, 3, and 4.

The Wan '825 Patent

A magnetic field sensor 10 includes four magnetoresistors 24, 26, 28, and 30 which utilize "barber pole" biasing and which are arranged as a Wheatstone

bridge. Each of the magnetoresistors 24, 26, 28, and 30 is an array of nine parallel magnetoresistive strips electrically connected in series with one another.

A set-reset coil 54 includes segments 60 which pass perpendicularly across the magnetoresistors 28 and 30, and segments 62 which pass perpendicularly across the magnetoresistors 24 and 26. A current in the set-reset coil 54 causes a magnetization in the magnetoresistors 28 and 30 that is opposite to the magnetization caused in the magnetoresistors 24 and 26.

A current in a coil 70 generates a magnetic field in the sensitive direction of the magnetoresistors 24, 26, 28, and 30. The coil 70 includes portions 72 and 74. Segments of the portion 72 are spaced from and aligned along the magnetoresistors 24 and 28, and segments 78 of the portion 74 are spaced from and aligned along the magnetoresistors 26 and 30. When a DC current flows through the coil 70, a magnetic field is created in a direction perpendicular to the magnetoresistors 24, 26, 28, and 30, i.e., in the sensitive direction of the magnetoresistors 24, 26, 28, and 30. This current unbalances the bridge and provides a bridge output at pads 36 and 52.

By passing the given current through the coil 70 and measuring the output voltage at pads 36 and 52,

the relationship between a known input or test magnetic field and the output voltage can be determined. Alternatively, the coil 70 can be calibrated by placing it in a known magnetic field and measuring the current required in the coil 70 to bring the output voltage to null. The coil 70 may also be used to produce a magnetic field at the magnetoresistors 24, 26, 28, and 30 in order to offset or balance out an existing external magnetic field. The coil 70 can also be used as a feedback coil to keep the magnetic field sensor 10 at a "0" output condition.

As shown in Figure 1a, the magnetoresistors 24, 26, 28, and 30 are formed in a first dielectric 102 over a substrate 100, the coil 70 is formed in a second dielectric 104 over the first dielectric 102, the set-reset coil is formed over the second dielectric 104 and in a passivation layer 106.

Issue (a)

Independent claim 1 is directed to an integrated signal isolator having first and second ends. The integrated signal isolator comprises first and second isolator input terminals, first and second isolator output terminals, first and second power supply terminals, first, second, third, and fourth

magnetoresistors, and an input strap. The first and second magnetoresistors are coupled to the first isolator output terminal, the second and third magnetoresistors are coupled to the first supply terminal, the third and fourth magnetoresistors are coupled to the second isolator output terminal, and the first and fourth magnetoresistors are coupled to the second supply terminal. The input strap has at least one turn coupled between the first and second isolator input terminals. The input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that a magnetic field is generated over two of the magnetoresistors in one direction, and so that a magnetic field is generated over the other two of the magnetoresistors in an opposite direction.

Appellant has raised several points to show that the Lienhard '950 patent does not anticipate independent claim 1.

APPLICANT'S POINT 1 - As can be seen from Figure 1 of the Lienhard '950 patent, the magnetic field produced by the input coil 9 is in the same direction at each of the four magnetoresistors 1, 2, 3, and 4. Therefore, the input coil 9 is not disposed as required by independent claim 1. That is, the input coil 9 disclosed in the Lienhard '950 patent is not disposed

with respect to the first, second, third, and fourth magnetoresistors 1, 2, 3, and 4 so that a magnetic field is generated over two of the magnetoresistors in one direction, and so that a magnetic field is generated over the other two of the magnetoresistors in an opposite direction.

EXAMINER'S RESPONSE - The Examiner recognizes that neither the input coil 9 nor the feedback coil 10 taken individually generates a magnetic field over two magnetoresistors in one direction and a magnetic field over two other magnetoresistors in the opposite direction. That is, as shown in Figures 1 and 2, the input coil 9 generates a field H_m over all of the magnetoresistors in the same direction, and the feedback coil 10 likewise generates a field H_h over all of the magnetoresistors in the same opposite direction. Therefore, there is no coil disclosed in Lienhard '950 patent that generates a magnetic field over two of the magnetoresistors in one direction and that generates a magnetic field over the other two of the magnetoresistors in the opposite direction.

Therefore, the Examiner argues that the input strap recited in independent claim 1 can be read on a combination of the input coil 9 and the feedback coil 10. Thus, the Examiner argues that the input coil 9 generates

a field in one direction, and the feedback coil 10 generates a field in an opposite direction and that, therefore, the Lienhard '950 patent discloses that a magnetic field is generated (by the input coil 9) over two of the magnetoresistors in one direction and that a magnetic field is generated (by the feedback coil 10) over the other two of the magnetoresistors in an opposite direction.

However, even if the input strap as recited in independent claim 1 can be read to include both the input coil 9 and the feedback coil 10 disclosed in the Lienhard '950 patent, the magnetoresistors 1, 2, 3, and 4 disclosed in the Lienhard '950 patent do not experience separate fields as do the magnetoresistors disclosed in the present application. As shown in Figure 2 of the Lienhard '950 patent, the magnetic field H_m generated by the input coil 9 and the magnetic field H_h generated by the feedback coil 10 combine as the magnetic field H_a. The magnetic field H_a is over all of the magnetoresistors 1, 2, 3, and 4 in the same direction.

By contrast, as shown in Figure 2 of the present application, the input strap 30 has a first segment running alongside the magnetoresistors 14 and 16 in one direction and a second segment running alongside

the magnetoresistors 18 and 20 in the other direction. Accordingly, because current runs through the first segment in one direction and current runs through the second segment in an opposite direction, the magnetoresistors 14 and 16 experience a magnetic field in one direction and the magnetoresistors 18 and 20 experience a magnetic field in the opposite direction.

The Lienhard '950 patent discloses no such relationship between any of its coils and the magnetoresistors 1-4 and, therefore, two of the magnetoresistors 1-4 do not experience a magnetic field in one direction while the other two magnetoresistors 1-4 experience a magnetic field in an opposite direction.

Moreover, even the Lienhard '950 patent recognizes that the magnetoresistors 1-4 experience only one magnetic field when it discloses at column 2, lines 51-54 that "[t]he Wheatstone bridge 5 is fed by a current- or voltage-source 6, and constitutes a magnetic transducer having output terminals 7 and 8, which is subjected to an external magnetic field H_a." The Lienhard '950 patent does not disclose that the magnetoresistors 1-4 experience separate magnetic fields H_m and H_h.

The finite delay in the generation of the magnetic field H_h mentioned by the Examiner is immaterial because the magnetic fields H_m and H_h still combine to form the magnetic field H_a and, therefore, the magnetoresistors 1-4 are not subjected to magnetic fields in different directions. The finite delay only means that there is some period of time when the magnetic field H_m is not balanced by the magnetic field H_h.

Accordingly, the Lienhard '950 patent does not disclose magnetoresistors experiencing magnetic fields in different directions as recited in independent claim 1. Therefore, the Lienhard '950 patent does not anticipate independent claim 1 and dependent claims 2, 3, 6, 7, and 31.

APPLICANT'S POINT 2 - The input strap as recited in independent claim 1 cannot be read to include both the input coil 9 and the feedback coil 10 disclosed in the Lienhard '950 patent because both the input coil 9 and the feedback coil 10 are not coupled between the first and second isolator input terminals as required by independent claim 1.

If the input coil 9 is coupled between first and second isolator input terminals, the feedback coil 10

is not likewise coupled between these first and second isolator input terminals. The feedback coil 10 is at most coupled to first and second isolator output terminals. Moreover, the feedback coil 10 is a feedback coil, not an input coil.

EXAMINER'S RESPONSE - The Examiner argues that, because the input coil 9 and the feedback coil 10 are magnetically coupled, and because the input coil 9 is coupled between the first and second isolator input terminals, the feedback coil 10 is also coupled between the first and second isolator input terminals. However, the Lienhard '950 patent does not show that the feedback coil 10 is coupled between the first and second isolator input terminals. Moreover, it is not even correct to say that the feedback coil 10 is magnetically coupled between the first and second isolator input terminals.

Accordingly, the Lienhard '950 patent does not disclose an input strap that is coupled between the first and second isolator input terminals and that generates a field in a first direction across two magnetoresistors and a field in an opposite direction across two other magnetoresistors as required by independent claim 1. Therefore, the Lienhard '950 patent does not anticipate independent claim 1 and dependent claims 2, 3, 6, 7, and 31.

APPLICANT'S POINT 3 -Figures 4 and 5 of the Lienhard '950 patent show magnetic fields H_b. However, the magnetic fields H_b are not produced by the input coil of a signal isolator. Instead, in Figure 4, the magnetic fields H_b are produced by current flowing through a separate current-carrying loop 30 and, in Figure 5, the magnetic fields H_b are produced by permanently magnetized layers 13, 14, 15, and 16.

EXAMINER'S RESPONSE - The Examiner argues that independent claim 1 does not preclude the current-carrying loop 30 from being coupled to the isolator input terminals. However, independent claim 1 does preclude the current-carrying loop 30 from being coupled to the isolator input terminals. Independent claim 1 requires the input coil to be coupled to the isolator input terminals. The isolator input terminals are terminals that are coupled to a circuit that is to be isolated from another circuit. The Lienhard '950 patent does not disclose that the current I_b is from a circuit that is to be isolated from another circuit. Instead, the Lienhard '950 patent discloses that the current I_b is used to set the direction of the magnetizing vector M of the magnetoresistors 1, 2, 3, and 4. It is the input coil 9

that is coupled to the isolator input terminals because it is the signal I_m that is to be isolated.

Accordingly, for all of the reasons given above, the Lienhard '950 patent does not anticipate independent claim 1 and dependent claims 2, 3, 6, 7, and 31.

Independent claim 11 is directed to an integrated signal isolator having first and second ends. The integrated signal isolator comprises first, second, third, and fourth magnetoresistors, and an input strap. The first and second magnetoresistors are coupled to a first isolator output terminal, the second and third magnetoresistors are coupled to a first supply terminal, the third and fourth magnetoresistors are coupled to a second isolator output terminal, and the first and fourth magnetoresistors are coupled to a second supply terminal. The input strap has at least one turn coupled between first and second isolator input terminals. The at least one turn has a first portion running alongside two of the magnetoresistors and a second portion running alongside the other two magnetoresistors. The at least one turn is arranged so that current supplied to the input strap flows through the first portion in a first direction between the first and second ends and through the second portion in a second direction between the first and

second ends, and the first and second directions are substantially opposite to one another.

The Lienhard '950 patent does not disclose that a first portion of the input coil 9 runs alongside two of the magnetoresistors 1, 2, 3, and 4 and that a second portion of the input coil 9 runs alongside the other two magnetoresistors 1, 2, 3, and 4. The Lienhard '950 patent also does not show that current supplied to the input coil 9 flows through the first portion in a first direction between the first and second ends of the integrated signal isolator and through the second portion in a second opposite direction between the first and second ends of the integrated signal isolator.

<u>EXAMINER'S RESPONSE</u> - The Examiner argues that the whole of the input coil 9 disclosed in the Lienhard '950 patent runs alongside all resistors and, therefore, the input coil 9 must have a portion of a turn running alongside two of the magnetoresistors 1-4 and another portion of the turn running alongside the other two of the magnetoresistors 1-4.

The Examiner does not point to any figure in the Lienhard '950 patent showing the relationship between the input coil 9 and the magnetoresistors 12, 3, and 4 that is suggested by the Examiner. Figure 1 does not show that the input coil is alongside any of the

magnetoresistors 1-4. Figure 2 merely shows that the current I_m in the input coil 9 flows in the same direction with respect to all of the magnetoresistors 1, 2, 3, and 4.

As can be seen, the Lienhard '950 patent does not disclose or show an input strap that is coupled between first and second isolator input terminals and that has a first portion running alongside two of the magnetoresistors 1-4 and a second portion running alongside the other two of the magnetoresistors 1-4 so that current is supplied through the first portion in one direction between first and second ends of an integrated signal isolator and through the second portion in an opposite direction between the first and second ends of the integrated signal isolator.

Moreover, for the reasons given above, the input strap of independent claim 11 cannot be read on a combination of the input coil 9 and the feedback coil 10 or on the current-carrying loop 30.

Accordingly, the Lienhard '950 patent does not anticipate independent claim 11 and dependent claims 12-14.

<u>Dependent claim 2</u> recites that the at least one turn of the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so

that, when input current flows between the first and second isolator input terminals, a first field is generated across the first and second magnetoresistors and a second field is generated across the third and fourth magnetoresistors and so that the first and second fields point in substantially opposite directions thereby producing an output across the first and second isolator output terminals commensurate with the input current.

As discussed above, the input strap of dependent claim 2 cannot be read on the input coil 9, or on a combination of the input coil 9 and the feedback coil 10, or on the current-carrying loop 30.

Moreover, the Lienhard '950 patent does not disclose that the input coil 9, or the combination of the input coil 9 and the feedback coil 10, or the current-carrying loop 30 produces first and second fields that point in substantially opposite directions to thereby produce an output across first and second isolator output terminals commensurate with an input current.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 2.

Dependent claim 3 recites that the input strap includes a plurality of turns, which excludes the embodiment of the Lienhard '950 patent shown in Figures 2, 3, and 5.

As discussed above, the input strap of dependent claim 3 cannot be read on the input coil 9 or on a combination of the input coil 9 and the feedback coil 10 as shown in Figure 1 of the Lienhard '950 patent, or on the current-carrying loop 30 as shown in Figure 4 of the Lienhard '950 patent.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 3.

Dependent claim 6 recites that the first, second, third, and fourth magnetoresistors are in a first layer, that the input strap is in a second layer, and that the first and second layers are separate layers, which excludes the embodiment of the Lienhard '950 patent shown in Figures 2 and 3.

As discussed above, the input strap of dependent claim 6 cannot be read on the input coil 9 or on a combination of the input coil 9 and the feedback coil 10 as shown in Figure 1 of the Lienhard '950 patent, or on the current-carrying loop 30 as shown in Figure 4 of the Lienhard '950 patent.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 6.

Dependent claim 12 recites that the input strap includes a plurality of turns, which excludes the

embodiment of the Lienhard '950 patent shown in Figures 2, 3, and 5.

As discussed above, the input strap of dependent claim 3 cannot be read on the input coil 9 or on a combination of the input coil 9 and the feedback coil 10 as shown in Figure 1 of the Lienhard '950 patent, or on the current-carrying loop 30 as shown in Figure 4 of the Lienhard '950 patent.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 12.

Dependent claim 13 recites that the first, second, third, and fourth magnetoresistors are in a first layer, that the input strap is in a second layer, and that the first and second layers are separate layers, which excludes the embodiment of the Lienhard '950 patent shown in Figures 2 and 3.

As discussed above, the input strap of dependent claim 6 cannot be read on the input coil 9 or on a combination of the input coil 9 and the feedback coil 10 as shown in Figure 1 of the Lienhard '950 patent, or on the current-carrying loop 30 as shown in Figure 4 of the Lienhard '950 patent.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 13.

Dependent claim 31 recites that the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that, when input current flows between the first and second isolator input terminals, a resistance of the first magnetoresistor tracks a resistance of the third magnetoresistor, and a resistance of the second magnetoresistor tracks a resistance of the fourth magnetoresistor.

There is no disclosure in the Lienhard '950 patent that the resistance of the each of the magnetoresistors 1, 2, 3, and 4 tracks the resistance of a magnetoresistor on the opposite side of the bridge.

Accordingly, the Lienhard '950 patent does not anticipate dependent claim 31.

Issue (b)

INDEPENDENT CLAIM 1 - The coil 70 disclosed in the Wan '825 patent is not disposed as required by independent claim 1. That is, the coil 70 is not disposed with respect to the magnetoresistors 24, 26, 28, and 30 so that a magnetic field is generated over two of these magnetoresistors in one direction, and so that a magnetic field is generated over the other two of these magnetoresistors in the opposite direction. Instead, current flowing in the coil 70 flows along all of the

magnetoresistors 24, 26, 28, and 30 in the same direction producing a magnetic field over all four of these magnetoresistors 24, 26, 28, and 30 in the same direction.

Because the coil 70 does not meet the limitations of independent claim 1, the Examiner points to the set-reset strap 54 disclosed in the Wan '825 patent as the input strap of independent claim 1. However, the set-reset strap 54 is not coupled between first and second isolator input terminals, i.e., the terminals that carry the signal from a circuit that is to be isolated from another circuit.

Moreover, the Wan '825 patent refers to U.S. Pat. No. 5,247,278 in describing the set-reset function. As described in the '278 patent, a set-reset strap is used to set the direction of magnetization in magnetoresistive elements so as to eliminate any offset that might otherwise result. The duration of the current in set-reset strap is very short, less than a microsecond.

As can be seen, the Wan '825 patent does not disclose or even suggest that the set-reset strap 54 be used as an input strap coupled between first and second isolator input terminals so that circuits can be isolated from one another. Indeed, the Wan '825 patent suggests

just the opposite. Thus, those practicing in the art of magnetoresistive isolators will understand that a set-reset strap is not an input strap.

Additionally, the only time that the Wan '825 patent uses the term "input" is in relation to the coil 70. The Wan '825 patent does not use the term "input" in relation to the set-reset strap 54.

EXAMINER'S RESPONSE - The Examiner argues that the set-reset strap 54 can be referred to as an input strap or can function as an input strap because it meets the limitations of independent claim 1.

However, the Examiner has not shown that the set-reset strap 54 can function as the input strap of a signal isolator. Indeed, as discussed above, the Wan '825 patent discloses that the coil 70 generates a magnetic field in the sensitive direction of the magnetoresistive elements 24, 26, 28 and 30, while the set-reset strap 54 sets the direction of magnetization in magnetoresistive elements so as to eliminate any offset that might otherwise result. Accordingly, using the set-reset strap 54 as the input coil of a signal isolator and using the coil 70 as the set-reset strap will not produce a device that functions properly.

The Examiner also argues that the magnetoresistors 24, 26, 28, and 30 see an input from the

set-reset strap 54 and, therefore, the set-reset strap 54 can be again referred to as an input strap. However, the set-reset coil 54 does not receive the input of a signal isolator. Independent claim 1 requires the coupling of the input strap between first and second isolator input terminals of a integrated signal isolator. A signal isolator isolates two circuits from each other. Thus, the set-reset strap 54 disclosed in the Wan '825 patent is not coupled between first and second isolator input terminals of an integrated signal isolator.

Moreover, calling a set-reset strap an input strap does not make the set-reset strap an input strap.

Accordingly, because the coil 70 disclosed in the Wan '825 patent does not produce the magnetic fields as required by independent claim 1, because the set-reset strap 54 disclosed in the Wan '825 patent is not coupled between first and second isolator input terminals as required by independent claim 1, and because the sensor disclosed in the Wan '825 patent will not function properly if the set-reset strap 54 is used as the input strap of a signal isolator, the Wan '825 patent does not anticipate independent claim 1 and dependent claims 2-10 and 31-35.

INDEPENDENT CLAIM 11 - As seen above, the Wan '825 patent does not disclose the relationship between

the input strap 70 and the magnetoresistors 24, 26, 28, and 30 as recited in independent claim 11. That is, although the Wan '825 patent shows a first portion of the input strap 70 running alongside two of the magnetoresistors 24, 26, 28, and 30 and a second portion running alongside the other two magnetoresistors 24, 26, 28, and 30, the Wan '825 patent does not show that current supplied to the input strap 70 flows through the first portion in a first direction and through the second portion in a second opposite direction. Instead, the Wan '825 patent shows that current supplied to the input strap 70 flows through the first and second portions in the same first direction.

The Examiner, however, argues that the set-reset strap 54 disclosed in the Wan '825 patent meets these limitations. However, as discussed above, the set-reset strap 54 does not meet the input strap limitation. That is, the Wan '825 patent does not suggest that the set-reset strap 54 be coupled between first and second isolator input terminals of an integrated signal isolator for the purpose of isolating circuits from one another. Thus, those practicing in the art of magnetoresistive isolators will understand that a set-reset strap is not an input strap.

Additionally, the only time that the Wan '825 patent uses the term "input" is in relation to the input strap 70. The Wan '825 patent does not use the term "input" in relation to the set-reset strap 54.

Moreover, calling a set-reset strap an input strap does not make the set-reset strap an input strap.

EXAMINER'S RESPONSE - The Examiner argues that the set-reset strap 54 can be used as the input strap recited in independent claim 11 (and independent claim 1). However, none of the references suggest that a set-reset strap can be used as the input strap of an integrated signal isolator, and the Examiner has provided no evidence (other than applicant's own disclosure) that the device disclosed in the Wan '825 patent can operate properly if the set-reset strap 54 is used as the input strap of an integrated signal isolator as recited in independent claim 11. Indeed, as discussed above, a signal isolator will not function properly if the set-reset strap 54 disclosed in the Wan '825 patent is used as the input strap of the signal isolator.

The Examiner further argues that applicant has pointed to no structural limitations that renders the device recited in the independent claims distinct from the device disclosed in the Wan '825 patent. However, applicants have pointed to the structural limitation of

"input strap" which is distinct from a set-reset strap, and to the structural limitation that the input strap is coupled between the first and second isolator input terminals of an integrated signal isolator, which the set-reset strap 54 is not.

Accordingly, for all of the reasons given above, the Wan '825 patent does not anticipate independent claim 11 and dependent claims 12-17.

Dependent claim 2 recites that the at least one turn of the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that, when input current flows between the first and second isolator input terminals, a first field is generated across the first and second magnetoresistors and a second field is generated across the third and fourth magnetoresistors and so that the first and second fields point in substantially opposite directions thereby producing an output across the first and second isolator output terminals commensurate with the input current.

As discussed above, the coil 70 disclosed in the Wan '825 patent is not disposed so that a magnetic field is generated across the first and second magnetoresistors that is opposite to the magnetic field generated across the third and fourth magnetoresistors.

As also discussed above, the set-reset strap 54 disclosed in the Wan '825 patent is not an input strap of a signal isolator, and the set-reset strap 54 cannot be used as an input strap of a signal isolator.

Moreover, the set-reset strap 54 does not generate fields across the magnetoresistors 24, 26, 28, and 30 but rather along the magnetoresistors 24, 26, 28, and 30.

Accordingly, for all of these reasons, the Wan '825 patent does not anticipate dependent claim 2.

Dependent claim 3 recites that the input strap includes a plurality of turns. As discussed above, the input strap of dependent claim 3 cannot be read on the either the coil 70 or the set-reset strap 54 of the Wan '825 patent.

Accordingly, the Wan '825 patent does not anticipate dependent claim 3.

Dependent claim 4 recites that each of the first, second, third, and fourth magnetoresistors comprises a serpentine structure having a plurality of elongated magnetoresistive portions coupled end-to-end, that the elongated portions of two of the magnetoresistors are positioned near and in parallel to a first elongated portion of each of the turns of the input strap, that the elongated portions of the other two

magnetoresistors are position near and in parallel to a second elongated portion of each of the turns of the input strap, and that the first elongated portions of the turns of the input strap are parallel to the second elongated portions of the turns of the input strap.

The set-reset strap 54 disclosed in the Wan '825 patent runs across the elongated portions of the magnetoresistors 24, 26, 28, and 30 and are not in parallel thereto. The coil 70 disclosed in the Wan '825 patent does run in parallel to the elongated portions of the magnetoresistors 24, 26, 28, and 30. However, the coil 70 does not produce the opposing fields recited in the independent claim 1.

Accordingly, the Wan '825 patent does not anticipate dependent claim 4.

<u>Dependent claim 5</u> recites that each of the first, second, third, and fourth magnetoresistors comprises a serpentine structure having a plurality of elongated magnetoresistive portions coupled end-to-end, that the elongated portions of the first and second magnetoresistors are position near and in parallel to a first elongated portion of each of the turns of the input strap, that the elongated portions of the third and fourth magnetoresistors are position near and in parallel to a second elongated portion of each of the turns of the

input strap, and that the first elongated portions of the turns of the input strap are parallel to the second elongated portions of the turns of the input strap.

As in the case of dependent claim 4, the set-reset strap 54 disclosed in the Wan '825 patent runs across the elongated portions of the magnetoresistors 24, 26, 28, and 30 and are not in parallel thereto. The coil 70 disclosed in the Wan '825 patent does run in parallel to the elongated portions of the magnetoresistors 24, 26, 28, and 30. However, the coil 70 does not produce the opposing fields recited in the independent claim 1.

Accordingly, the Wan '825 patent does not anticipate dependent claim 5.

Dependent claim 6 recites that the first, second, third, and fourth magnetoresistors are in a first layer, that the input strap is in a second layer, and that the first and second layers are separate layers.

As discussed above, the input strap of dependent claim 6 cannot be read on the coil 70 or on the set-reset strap 54 of the Wan '825 patent.

Accordingly, the Wan '825 patent does not anticipate dependent claim 6.

Dependent claim 9 recites that a set-reset coil has a plurality of clockwise turns and a plurality of counterclockwise turns, that each clockwise turn of the

set-reset coil has a portion running across the first and fourth magnetoresistors, that each counterclockwise turn of the set-reset coil has a portion running across the second and third magnetoresistors, and that the clockwise and counterclockwise turns are arranged so that current supplied to the set-reset coil flows through the portions of each of the clockwise and counterclockwise turns in the same direction.

The Wan '825 patent discloses no coil that has clockwise turns running across two magnetoresistors and counterclockwise turns running across two other magnetoresistors. The turns of the coil 70 run along and not across the magnetoresistors 24, 26, 28, and 30, and the turns of the set-reset strap 54 run across the magnetoresistors 24, 26, 28, and 30 in the same clockwise direction.

Accordingly, the Wan '825 patent does not anticipate dependent claim 9.

Dependent claim 10 requires a set-reset coil that has turns disposed so that the set-reset coil generates a magnetic field across the first, second, third, and fourth magnetoresistors in the same direction.

The set-reset strap 54 does not generate fields across the magnetoresistors 24, 26, 28, and 30 but rather along the magnetoresistors 24, 26, 28, and 30. The coil

70 generates fields across the magnetoresistors 24, 26, 28, and 30. However, contrary to the provisions of independent claim 1, the fields generated by the coil 70 cross the magnetoresistors 24, 26, 28, and 30 all in the same direction.

Accordingly, the Wan '825 patent does not anticipate dependent claim 10.

Dependent claim 12 recites that the input strap includes a plurality of turns. As discussed above, the input strap of dependent claim 12 cannot be read on the either the coil 70 or the set-reset strap 54 of the Wan '825 patent.

Accordingly, the Wan '825 patent does not anticipate dependent claim 12.

Dependent claim 13 recites that the first, second, third, and fourth magnetoresistors are in a first layer, that the input strap is in a second layer, and that the first and second layers are separate layers.

As discussed above, the input strap of dependent claim 13 cannot be read on the coil 70 or on the set-reset strap 54 of the Wan '825 patent.

Accordingly, the Wan '825 patent does not anticipate dependent claim 13.

Dependent claim 16 recites a set-reset coil that has a plurality of clockwise turns and a plurality

of counterclockwise turns such that each clockwise turn of the set-reset coil has a portion running across the first and fourth magnetoresistors, such that each counterclockwise turn of the set-reset coil has a portion running across the second and third magnetoresistors, and such that the clockwise and counterclockwise turns are arranged so that current supplied to the set-reset coil flows through the portions of each of the clockwise and counterclockwise turns in the same direction.

The Wan '825 patent discloses no coil that has clockwise turns running across two magnetoresistors and counterclockwise turns running across two other magnetoresistors. The turns of the coil 70 run along and not across the magnetoresistors 24, 26, 28, and 30, and the turns of the set-reset strap 54 run across the magnetoresistors 24, 26, 28, and 30 in the same clockwise direction.

Accordingly, the Wan '825 patent does not anticipate dependent claim 16.

<u>Dependent claim 17</u> recites that a set-reset coil has a plurality of turns disposed with respect to the first, second, third, and fourth magnetoresistors so that the set-reset coil generates a magnetic field across the first, second, third, and fourth magnetoresistors in the same direction.

The set-reset strap 54 does not generate fields across the magnetoresistors 24, 26, 28, and 30 but rather along the magnetoresistors 24, 26, 28, and 30. The coil 70 generates fields across the magnetoresistors 24, 26, 28, and 30. However, contrary to the provisions of independent claim 11, the current supplied to the coil 70 does not flow along two of the magnetoresistors 24, 26, 28, and 30 in one direction and along the other two of the magnetoresistors 24, 26, 28, and 30 in the opposite direction.

Accordingly, the Wan '825 patent does not anticipate dependent claim 17.

Dependent claim 31 recites that the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that, when input current flows between the first and second isolator input terminals, a resistance of the first magnetoresistor tracks a resistance of the third magnetoresistor, and a resistance of the second magnetoresistor tracks a resistance of the fourth magnetoresistor.

There is no disclosure in the Wan '825 patent that the resistance of the each of the magnetoresistors 24, 26, 28, and 30 tracks the resistance of a magnetoresistor on the opposite side of the bridge.

Accordingly, the Wan '825 patent does not anticipate dependent claim 31.

Dependent claim 32 recites that the input strap has a first portion running along a length of two of the magnetoresistors and a second portion running along a length of two others of the magnetoresistors.

The set-reset strap 54 of the Wan '825 patent has no portions running along the magnetoresistors 24, 26, 28, and 30. Instead, the set-reset strap 54 has portions running across the magnetoresistors 24, 26, 28, and 30. The coil 70 of the Wan '825 patent has portions running along the magnetoresistors 24, 26, 28, and 30. However, the coil 70 does not meet the input strap limitations of independent claim 1.

Accordingly, the Wan '825 patent does not anticipate dependent claim 32.

Dependent claim 33 recites that the first portion of the input strap runs along the length of the first and second magnetoresistors and the second portion of the input strap runs along the length of the third and fourth magnetoresistors.

The set-reset strap 54 of the Wan '825 patent has no portions running along the magnetoresistors 24, 26, 28, and 30. Instead, the set-reset strap 54 has portions running across the magnetoresistors 24, 26, 28,

and 30. The coil 70 of the Wan '825 patent has portions running along the magnetoresistors 24, 26, 28, and 30. However, the coil 70 does not meet the input strap limitations of independent claim 1.

Accordingly, the Wan '825 patent does not anticipate dependent claim 33.

Dependent claim 34 recites that a set/reset strap is positioned to generate a set/reset magnetic field over the magnetoresistors.

If the Examiner reads the set-reset strap 54 of the Wan '825 patent as the input strap of a signal isolator, the only other coil disclosed in the Wan '825 patent is the coil 70, and the coil 70 does not generate a set/reset magnetic field.

Accordingly, the Wan '825 patent does not anticipate dependent claim 34.

Dependent claim 35 recites that the set/reset strap perpendicularly crosses the length of the magnetoresistors in the same direction so as to carry current across the magnetoresistors in the same direction.

The only coil disclosed in the Wan '825 patent that crosses the length of the magnetoresistors 24, 26, 28, and 30 is the set-reset strap 54, and the Examiner has already used the set-reset strap 54 as the input

strap of independent claim 1. Moreover, the set-reset strap 54 does not perpendicularly cross the length of the magnetoresistors so as to carry current across the magnetoresistors in the same direction

Accordingly, the Wan '825 patent does not anticipate dependent claim 35.

For the foregoing reasons, reversal of the Final Rejection is respectfully requested.

9. Appendix

The Appendix containing a copy of the claims involved in this appeal is attached hereto.

This brief is being filed in triplicate as required by 37 C.F.R. §1.192.

The fee set forth in 37 C.F.R. §1.17(c) is enclosed herein by check. The Commissioner is hereby authorized to charge any deficiency in the amount enclosed or any additional fee which may be required to Deposit Account No. 50-1519.

Respectfully submitted,

Schiff, Hardin & Waite
6600 Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606
(312) 258-5500

By: Melvin A. Robinson
Reg. No: 31,870

November 17, 2003

APPENDIX

1. An integrated signal isolator having first and second ends, wherein the integrated signal isolator comprises:

first and second isolator input terminals;

first and second isolator output terminals;

first and second power supply terminals;

first, second, third, and fourth magnetoresistors, wherein the first and second magnetoresistors are coupled to the first isolator output terminal, wherein the second and third magnetoresistors are coupled to the first supply terminal, wherein the third and fourth magnetoresistors are coupled to the second isolator output terminal, and wherein the first and fourth magnetoresistors are coupled to the second supply terminal; and,

an input strap having at least one turn coupled between the first and second isolator input terminals, wherein the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that a magnetic field is generated over two of the magnetoresistors in one direction, so that a magnetic field is generated over the other two of the magnetoresistors in an opposite direction.

2. The integrated signal isolator of claim 1 wherein the at least one turn of the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that, when input current flows between the first and second isolator input terminals, a first field is generated across the first and second magnetoresistors and a second field is generated across

the third and fourth magnetoresistors and so that the first and second fields point in substantially opposite directions thereby producing an output across the first and second isolator output terminals commensurate with the input current.

3. The integrated signal isolator of claim 1 wherein the input strap includes a plurality of turns.

4. The integrated signal isolator of claim 3 wherein each of the first, second, third, and fourth magnetoresistors comprises a serpentine structure having a plurality of elongated magnetoresistive portions coupled end-to-end, wherein the elongated portions of two of the magnetoresistors are position near and in parallel to a first elongated portion of each of the turns of the input strap, wherein the elongated portions of the other two magnetoresistors are position near and in parallel to a second elongated portion of each of the turns of the input strap, and wherein the first elongated portions of the turns of the input strap are parallel to the second elongated portions of the turns of the input strap.

5. The integrated signal isolator of claim 3 wherein each of the first, second, third, and fourth magnetoresistors comprises a serpentine structure having a plurality of elongated magnetoresistive portions coupled end-to-end, wherein the elongated portions of the first and second magnetoresistors are position near and in parallel to a first elongated portion of each of the turns of the input strap, wherein the elongated portions of the third and fourth magnetoresistors are position near and in parallel to a second elongated portion of each of the turns of the input strap, and wherein the

first elongated portions of the turns of the input strap are parallel to the second elongated portions of the turns of the input strap.

6. The integrated signal isolator of claim 1 wherein the first, second, third, and fourth magnetoresistors are in a first layer, wherein the input strap is in a second layer, and wherein the first and second layers are separate layers.

7. The integrated signal isolator of claim 6 further comprising a dielectric between the input strap and the first, second, third, and fourth magnetoresistors.

8. The integrated signal isolator of claim 7 wherein the dielectric is a first dielectric, wherein the integrated signal isolator further comprises a second dielectric over the input strap, and wherein the first, second, third, and fourth magnetoresistors are formed over a substrate and under the first dielectric.

9. The integrated signal isolator of claim 1 further comprising a set-reset coil having a plurality of clockwise turns and a plurality of counterclockwise turns, wherein each clockwise turn of the set-reset coil has a portion running across the first and fourth magnetoresistors, wherein each counterclockwise turn of the set-reset coil has a portion running across the second and third magnetoresistors, and wherein the clockwise and counterclockwise turns are arranged so that current supplied to the set-reset coil flows through the portions of each of the clockwise and counterclockwise turns in the same direction.

10. The integrated signal isolator of claim 1 further comprising a set-reset coil having a plurality of turns disposed with respect to the first, second, third, and fourth magnetoresistors so that the set-reset coil generates a magnetic field across the first, second, third, and fourth magnetoresistors in the same direction.

11. An integrated signal isolator having first and second ends, wherein the integrated signal isolator comprises:

first, second, third, and fourth magnetoresistors, wherein the first and second magnetoresistors are coupled to a first isolator output terminal, wherein the second and third magnetoresistors are coupled to a first supply terminal, wherein the third and fourth magnetoresistors are coupled to a second isolator output terminal, and wherein the first and fourth magnetoresistors are coupled to a second supply terminal; and,

an input strap having at least one turn coupled between first and second isolator input terminals, wherein the least one turn has a first portion running alongside two of the magnetoresistors and a second portion running alongside the other two magnetoresistors, wherein the at least one turn is arranged so that current supplied to the input strap flows through the first portion in a first direction between the first and second ends and through the second portion in a second direction between the first and second ends, and wherein the first and second directions are substantially opposite to one another.

12. The integrated signal isolator of claim 11 wherein the input strap includes a plurality of turns.

13. The integrated signal isolator of claim 11 wherein the first, second, third, and fourth magnetoresistors are in a first layer, wherein the input strap is in a second layer, and wherein the first and second layers are separate layers.

14. The integrated signal isolator of claim 11 further comprising a dielectric between the input strap and the first, second, third, and fourth magnetoresistors.

15. The integrated signal isolator of claim 14 wherein the dielectric is a first dielectric, wherein the integrated signal isolator further comprises a second dielectric over the input strap, and wherein the first, second, third, and fourth magnetoresistors are formed over a substrate and under the input strap.

16. The integrated signal isolator of claim 11 further comprising a set-reset coil having a plurality of clockwise turns and a plurality of counterclockwise turns, wherein each clockwise turn of the set-reset coil has a portion running across the first and fourth magnetoresistors, wherein each counterclockwise turn of the set-reset coil has a portion running across the second and third magnetoresistors, and wherein the clockwise and counterclockwise turns are arranged so that current supplied to the set-reset coil flows through the portions of each of the clockwise and counterclockwise turns in the same direction.

17. The integrated signal isolator of claim 11 further comprising a set-reset coil having a plurality of turns disposed with respect to the first, second, third, and fourth magnetoresistors so that the set-reset coil generates a magnetic field across the first, second, third, and fourth magnetoresistors in the same direction.

31. The integrated signal isolator of claim 1 wherein the input strap is disposed with respect to the first, second, third, and fourth magnetoresistors so that, when input current flows between the first and second isolator input terminals, a resistance of the first magnetoresistor tracks a resistance of the third magnetoresistor, and a resistance of the second magnetoresistor tracks a resistance of the fourth magnetoresistor.

32. The integrated signal isolator of claim 1 wherein the input strap has a first portion running along a length of the two of the magnetoresistors and a second portion running along a length of the other two of the magnetoresistors.

33. The integrated signal isolator of claim 32 wherein the first portion runs along the length of the first and second magnetoresistors and the second portion runs along the length of the third and fourth magnetoresistors.

34. The integrated signal isolator of claim 1 further comprising a set/reset strap positioned to generate a set/reset magnetic field over the magnetoresistors.

35. The integrated signal isolator of claim 34 wherein the set/reset strap perpendicularly crosses a length of the magnetoresistors in the same direction so as to carry current across the magnetoresistors in the same direction.